NASA STTR 2007 Phase I Solicitation

T6.01 Wireless Surface Acoustic Wave (SAW) Sensor Arrays

Lead Center: KSC

Wireless surface acoustic wave (SAW) sensor arrays may have significant application in the ground processing of future spacecraft. These sensors do not require an embedded power source; instead they are powered by an RF interrogation pulse. Consequently, they have the promise of being essentially maintenance free, allowing them to be installed in normally inaccessible areas and provide environmental information for many years. In addition, as opposed to microprocessor based transponders, SAW devices can be designed to operate from cryogenic temperatures up to about 1000ºC. These characteristics have resulted in interest in this technology, not only for ground processing, but recently from both the NASA research and flight centers.

The Kennedy Space Center has been supporting the development of wireless SAW sensor arrays through prior STTR activities. A new communication system has been demonstrated, namely Orthogonal Frequency Coding, that allows access to an array of SAW sensors, each with its own unique identifier. Also, temperature sensors, cryogenic level sensors, and hydrogen sensors have been demonstrated under prior year funding. These are all of interest to the ground processing community, but further development in other types of wireless SAW sensors is desired. This call requests proposals for wireless SAW sensors that can monitor, for example, pressure, strain, near-by impacts/structural acoustic events, acceleration, proximity, magnetic field sensors, current, electric field, hypergols (monomethyl-hydrazine or nitrogen tetroxide), and moisture. This list is not exclusive and other sensors may also be of interest as well. In addition, alternative communication or multiplexing concepts are of interest, and enabling technologies, such as antenna design for SAW sensors, are welcome.

Applications for these sensors are diverse. When a vehicle is moved to the pad on a mobile launch platform strain sensors and accelerometers monitor the vehicle's sway, pressure sensors could be placed under sprayed on foam insulation to ensure bonding integrity up to launch, moisture sensors could be used to determine if water has migrated into inaccessible areas. Electric field sensors might help with lightening warnings, chemical sensors can improve safety, and magnetic field or current sensors can monitor valve performance. The goal is to maximize the ability to acquire information on these and other parameters while minimizing the need for cabling, maintenance, and operator labor. Wireless SAW sensor arrays appear to promote this goal.